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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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HEWLETT-PACKARD COMPANY			SIANGCHIN, KEVIN	
Intellectual Property Administration			ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/895,689	LUO, HUITAO
	Examiner	Art Unit
	Kevin Siangchin	2623

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 21 October 2004.

2a) This action is **FINAL**. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-24 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) Claim(s) _____ is/are allowed.
6) Claim(s) 1-24 is/are rejected.
7) Claim(s) _____ is/are objected to.
8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on 29 June 2001 is/are: a) accepted or b) objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) All b) Some * c) None of:
1. Certified copies of the priority documents have been received.
2. Certified copies of the priority documents have been received in Application No. _____.
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) Notice of References Cited (PTO-892)
2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____

4) Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ .
5) Notice of Informal Patent Application (PTO-152)
6) Other: _____

Detailed Action

Specification

Response to Arguments and Remarks

1. In the previous Office Action, filed the 7th of July 2004, the Specification was objected to because the Applicant failed to provide adequate definitions for the variables *width* and *height* (cf. Applicant's equation (8) on page 24 of the Specification). The Applicant, on the other hand, contends the "paragraph preceding equation (8) describes all the variables utilized in equation (8)" (cf. page 7 of the amendment, filed the 21st of October 2004; hereinafter, *Applicant's Remarks*). In particular, "the variables width and height are related to the picture in question [i.e.,] the ratio is obtained by comparing the histogram density ... of the picture with the average histogram density (width*height/255)". From this, the Applicant concludes "the picture's measurements are width and height".
2. Upon further consideration, the Examiner deems equation (8) sufficiently well-defined, and the definitions (mathematical and conceptual) of the variables *width* and *height* can be inferred from their relationship to the average histogram density. To clarify the meanings of these variables, for the record, the Examiner verifies the relationship between image dimensions and average histogram density in the appendix below. All previous objections to the Specification related to the variables *width* and *height* are, therefore, withdrawn.

Objections: Title of the Invention

3. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claims

Response to Amendments to the Claims

4. The amendments, filed on the 21st of October 2004, have been made of record. Claims 1, 7, 9, 11, and 17-18 have been amended accordingly.
5. These amendments overcome all prior objections to Claims due to the informalities listed in the Office Action, filed on the 15th of July 2004 (hereinafter, *Previous Office Action*). However, the amendments are not seen to overcome the rejections, under 35 U.S.C. § 102(b) and 103(a), posed in the Previous Office Action. This will be discussed below.

Response to Arguments and Remarks

6. The Applicant's arguments, filed on the 21st of October 2004 (hereinafter, *Applicant's Remarks*), have been fully considered but they are not persuasive.
7. Claims 1, 11, and 18 were rejected in the Previous Office Action, under 35 U.S.C. § 102(b), by [Nakai96] (Y. Nakai et al., *U.S. Patent 5,539,523: Image Forming Device Making Color Corrections on Stored Image Data*, Filing Date: September 1993). According to the Applicant's Remarks and as proposed in Claims 1, 11, and 18, the Applicant's claimed invention operates on "an original image having initial quality issues", thereby, "producing an enhanced digital image". The Applicant stresses that operations, such as claimed in Claims 1, 11, and 18, produce "an image that is different than the original", whereas [Nakai96] teaches a "method for reproducing an image that is extremely similar to the original image". These remarks serve as the basis for the Applicant's contention that [Nakai96] fails anticipate the subject matter of Claims 1, 11, and 18. Specifically, the Applicant contends that [Nakai96] teaches a "method for reproducing an image that is extremely similar to the original image", whereby an image is produced "having precise reproduction qualities for the human eye when compared to the original". The Applicant concludes from this observation that an image, produced in this manner, cannot be said to represent an

enhancement of the original image, but rather a reproduction thereof. [Nakai96], the Applicant asserts, thus fails to teach any enhancement of the image.

8. To motivate the Examiner's rebuttal, a brief synopsis of [Nakai96] is provided below. The merits of the Applicant's arguments are specifically addressed in the discussion that follows.

9. [Nakai96]. [Nakai96] discloses a method/device which is capable of reading and storing original image data, making color corrections on the stored digital image, and producing a color reproduction from the corrected stored image. An original image is scanned by a scanner, thus producing a digital image. Due to inevitable defects in the various optical and semiconductor components of the scanner and, more importantly, due to the inherent aliasing introduced by the digitization process, the digitized original may suffer from substantial color degradation and distortion. [Nakai96] is concerned primarily with the correction of such distortions in the digitized image so that a faithful reproduction of the original can be printed. To this end, [Nakai96] analyzes the digital image (as a whole) and, based upon that analysis, extracts flesh-colored regions of the face and hands (cf. [Nakai96] Fig. 3, column 8, ¶¹ 2, and column 2, lines 43-47). Other regions, such as sky-blue regions, are also extracted. The image is then subjected to a "region-specific" tone correction process.

10. The tone correction process utilizes tone correction matrices (e.g., matrices A, B, and C – cf. [Nakai96] Figs. 2 and 10, and column 8, ¶ 1) particular to each of the extracted regions (including the flesh regions) and the "non-extracted" regions (i.e., "normal colored areas"; cf. [Nakai96] column 8, ¶ 2 and column 2, ¶ 7). In essence, each region of the image is individually corrected according to parameters peculiar to that region. Multiple regression analysis can be used to derive the various matrices (cf. [Nakai96] column 2, ¶ 7). Each of these matrices embodies a transformation or function, mapping the domain of uncorrected color values to a range of corrected color values. In this sense, the various matrices of [Nakai96] (e.g., matrices A, B, and C) define "tone mapping functions", in accordance with Claims 1, 11, and 18. The result of this tone correction process is a digital image having regions,

¹ When referring to paragraphs in the cited references, the convention followed here is that the paragraph number is assigned to paragraphs of a given column (if applicable), section, or page, sequentially, beginning with the first full paragraph. Paragraphs that carry over to other columns or pages will be referred to as the last paragraph of the column or page in which they began.

such as flesh and “non-flesh” toned regions, which are optimally enhanced with respect to the defective *digitized* original.

11. The color correction process/device of [Nakai96] appears within the context of a printer/scanner application (cf. [Nakai96], Figs. 2 and 10), where the final output – i.e., a printed image – is expected to be a faithful reproduction of the original image. This, however, does not in any way preclude [Nakai96] from teaching the enhancement of a digital image, as the Applicant appears to allege. Indeed, it should be clear, even from a cursory perusal of [Nakai96], that the methodology/device disclosed therein is concerned primarily with the correction or enhancement of the digitally scanned image. As described above, after the original has been scanned, the captured digital image may exhibit some degree of color degradation with respect to the original. The primary function of the [Nakai96] device/method is to correct these distortions in a manner that is optimal for each region of the digital image.

12. It is important to realize that, within the context of [Nakai96], the original and the digital image undergoing enhancement are *not* the same. The latter is obtained via the scanner and will likely exhibit the color degradation described above. The original, on the other hand, may be a physical document input by the user (e.g., an original paper document or photograph) and represents the “ideal” to which the corrected digital image would be compared. The Applicant’s claimed invention is similar to [Nakai96] in this regard. The Applicant’s invention attempts to correct the color of a digital image, which may appear degraded relative to some “ideal”. Like [Nakai96], this degradation may be due to, among other things, optical artifacts or deficiencies in the scanning process (cf. Applicant’s Specification page 1, ¶ 2). That is, both [Nakai96] and the Applicant attempt to produce (or reproduce) an image having qualities that are subjectively agreeable to the human eye; the difference being that, in [Nakai96], such a subjective judgment would be made relative to the original, whereas, in the Applicant’s invention, that judgment would be made relative to a user’s preconceived notion of quality or correctness. Such a difference, however, is inconsequential because, regardless of the standard by which the correctness of the digital image is judged, [Nakai96] still teaches the enhancement of a digital image – namely, the digital image obtained after the scanning process. The Applicant’s arguments to the contrary are, therefore, flawed because the Applicant has improperly assumed that the original image and the digital image produced by the scanner are one and the same.

However, it should be clear from the preceding description of [Nakai96] that, in order to ensure the faithful reproduction of the former, the latter must undergo an enhancement. Again, the purpose of this enhancement is to compensate for distortions (i.e., “initial image quality issues” in the digital image) which may have arisen because of the scanning process.

13. The fact that the Applicant claims a method/apparatus for image enhancement does not alone distinguish it from the method/device of [Nakai96]. In his/her arguments, the Applicant does not appear to dispute the anticipation of the claimed elements (a)-(d) (cf. Claims 1, 11, and 18), but instead merely alludes to differences in the intended uses of [Nakai96] and his/her own claimed invention. Intended use does not, *per se*, distinguish the Applicant’s claimed invention from the teachings of [Nakai96] or any other Prior Art which can be shown to possess the claimed elements (a)-(d) (cf. *In re Schreiber*, 128 F.3d 1473, 1477, 44 USPQ2d 1429, 1431(Fed. Cir. 1997); furthermore, a preamble that recites the use or purpose of the claimed invention generally does not limit the claims – cf. *Catalina Marketing International Inc. v. Coolsavings.com Inc.*, 62 USPQ2d 1781 (CA FC 2002)). Thus, even if one accepts, *arguendo*, the Applicant’s somewhat shallow portrayal of [Nakai96] as being nothing more than a method/apparatus for image reproduction, [Nakai96] would still anticipate the Applicant’s method/apparatus of Claims 1, 11, and 18, since the former discloses every substantive element of the claims.

14. In summary, the method/device of [Nakai96] discloses the correction or enhancement of a digital image (i.e., the digital image produced by scanning a original) having “initial image quality issues” (e.g., distortions caused by the scanning process). As shown in the Previous Office Action, the digital enhancement process of [Nakai96] includes elements (a)-(d), as set forth in Claims 1, 11, and 18. This enhancement process is part of a larger reproduction process, which ultimately yields a faithful reproduction of the original. This, however, does not diminish the relevance of [Nakai96] to Claims 1, 11, and 18. Indeed, [Nakai96] is generally concerned with the color enhancement necessary to effect a faithful reproduction of the original, not the reproduction itself.

Rejections Under 35 U.S.C. § 102(b)

15. The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejection:

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this

country, more than one year prior to the date of application for patent in the United States.

16. Claims 1-4, 6, 8-9, 11-14, 16-20, and 23-24 are rejected under 35 U.S.C. 102(b) as being anticipated by [Nakai96].

17. *The following is in regard to Claims 1, 11, and 18.* [Nakai96] discloses a method for making color corrections (i.e., “enhancing image quality”) on stored image data. As discussed above, the stored image data is obtained by scanning an original. The stored image data is a digitized image of the original (i.e., an “original digital image”). As discussed above, the digital image suffers from distortions introduced by the scanning process (i.e., the digital image has “initial quality issues”).

18. The correction method of [Nakai96] includes:

- (1.a.) Locating human faces within the digital image. See, for example, [Nakai96] column 2, lines 43-47 and column 8, lines 14-24. Note there that extraction of the facial areas necessarily entails their location.
- (1.b.)
 - i. Analyzing the located and extracted human faces. See, for example, the analyses discussed in [Nakai96] column 10, lines 17-29 and column 2, equation (3) and lines 43-47.
 - ii. Analyzing the entire digital image. This could, for example, entail the digital image analyses discussed in [Nakai96] column 11, lines 43-52 and column 2, lines 26-34.
- (1.c.)
 - i. Determining a tone mapping function for enhancing the image quality of said digital image. See, for example, [Nakai96] column 4, lines 10-38, in conjunction with Fig. 10 and column 10, lines 34-51. The tone mapping is accomplished by the application of the various color correcting matrices corresponding to disparate extracted areas of the image (e.g. matrices A, B, and C of [Nakai96] Fig. 10). See [Nakai96] column 8, lines 14-24, equations (1)-(2) and column 4, lines 10-38. Therefore, these matrices

can, collectively, be regarded as the tone mapping function².

- ii. According to [Nakai96] ([Nakai96] column 8, lines 14-24), included in this set of matrices is a normal correcting matrix and a flesh correcting matrix. These are derived from an analysis of the entire image ([Nakai96] column 2, lines 26-34) and an analysis of the facial, flesh-tone regions ([Nakai96] column 2, lines 47-53), respectively.

- (1.d.) Applying the tone mapping function (i.e. the aforementioned collection of correction matrices) to the digital image so as to produce an enhanced digital image. Note steps 6 and 10 of [Nakai96] Fig. 10.

Thus, [Nakai96] teaches all elements of Claim 1. The rejections of Claims 11 and 18 follow similarly.

- 19. *The following is in regard to Claims 2-4, 6, 8-9, 12-14, 16-17, 19-20, and 23-24.* The rejections of Claims 2-4, 6, 8-9, 12-14, 16-17, 19-20, and 23-24 as set forth in the Previous Office Action are incorporated, herein, by reference. For the sake of brevity, the details of these rejections are omitted. Please refer to the appropriate sections of the Previous Office Action, as well as the discussion of [Nakai96] above.

Rejections Under 35 U.S.C. § 103(a)

- 20. The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

² Note that these matrices provide a relation from all colors (i.e. the entire domain) of the input image to the corrected output colors. Though conditionally applied over the domain of the image, these matrices can collectively be considered, in a mathematical sense, a function mapping the input (uncorrected) image colors to the output (corrected) image colors.

21. Claims 5, 10, 15, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over [Nakai96] in view of [Sakatani03] (K. Sakatani et al., *U.S. Patent 6,587,225: Image Processing Apparatus*, Filing Date: October 26, 1999).

22. *The following is in regard to Claims 5, 10, 15, and 21.* The rejections of Claims 5, 10, 15, and 21 as set forth in the Previous Office Action are incorporated, herein, by reference. For the sake of brevity, the details of these rejections are omitted. Please refer to the appropriate sections of the Previous Office Action, as well as the discussion of [Nakai96] above.

23. Claims 7 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over [Nakai96] in view of [Sonka98] (M. Sonka et al., *Image Processing: Analysis and Machine Vision*, 2nd Ed. © 1998 by Thomson-Engineering), in further view of [Materka98] (Materka et al., *Texture Analysis Methods – A Review*, University of Lodz Technical Report, 1998).

24. *The following is in regard to Claims 7 and 17.* The rejections of Claims 7 and 17 as set forth in the Previous Office Action are incorporated, herein, by reference. For the sake of brevity, the details of these rejections are omitted. Please refer to the appropriate sections of the Previous Office Action, as well as the discussion of [Nakai96] above.

25. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over [Nakai96], in view of [Sakatani03], in further view of [Sonka98] and [Materka98].

26. *The following is in regard to Claim 22.* The rejection of Claim 22 as set forth in the Previous Office Action is incorporated, herein, by reference. For the sake of brevity, the details of this rejection are omitted. Please refer to the appropriate sections of the Previous Office Action, as well as the discussion of [Nakai96] above.

Citation of Relevant Prior Art

27. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

[Kuwata03] N. Kuwata et al., *U.S. Patent 6,535,301: Image Processing Apparatus, Image Processing Method, Image Processing Program Recording Medium, Color Adjustment Method, Color Adjustment Device, And Color Adjustment Control Program Recording Medium*. Filing Date: June 1998.

[Kuwata03] discloses a “region-based” color adjustment method which includes, *inter alia*, steps for improving the contrast of the digital image undergoing adjustment. To achieve contrast enhancement, [Kuwata03] expands the width of the image’s luminance histogram. This has the effect of spreading the distribution of the histogram among all bins (i.e., the histogram becomes more uniform; see, e.g., [Kuwata03] Fig. 15).

Conclusion

28. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

29. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee

pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Appendix

30. The following demonstrates conclusively that the average histogram density of Applicant's equation (8) is indeed $(width \cdot height)/255$, where *width* and *height* are the horizontal and vertical dimensions of the image, respectively.

31. Assume a histogram $hist(i)$ of M bins measures the distribution of N samples, $X_1 \dots X_n$, where each bin has a width h and each sample X_j has a value that falls into exactly one of the M bins of $hist(i)$ (i.e., the bins are "mutually exclusive"). The (un-normalized) histogram density for a single bin i is $\delta(i) = hist(i)/h$. The average value of the density, $\delta_{average}$, over all bins is:

$$\delta_{average} = \frac{1}{Mh} \sum_{x=1}^M \delta(x) dx = \frac{1}{Mh} \sum_{x=1}^M \frac{hist(x)}{h} dx = \frac{1}{Mh} \sum_{x=1}^M \frac{hist(x)}{h} h = \frac{1}{Mh} \sum_{x=1}^M hist(x)$$

Since the bins are mutually exclusive, $\sum_{x=1}^M hist(x) = N$. Therefore, $\delta_{average} = N/(Mh)$.

32. In equation (8), the luminance histogram $hist(\cdot)$ has $M = 255$ bins, each having a width of $h = 1$. For an image with dimensions *width* \times *height*, the total number of pixels (samples) is $N = width \cdot height$ and the average histogram density is, therefore, $\delta_{average} = (width \cdot height)/255$.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Siangchin whose telephone number is (703)305-7569. The examiner can normally be reached on 9:00am - 5:30pm, Monday - Friday.

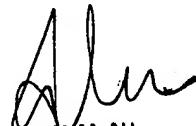
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on (703)308-6604. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Kevin Siangchin

Examiner
Art Unit 2623

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